8.4   ANNE ARUNDEL COUNTY

This chapter presents information about stream conditions of potential management interest in Anne Arundel County based on the 2000-2004 Maryland Biological Stream Survey (MBSS) results. Information from MBSS data collected between 1994 and 1997 can be found in MDNR 2001b.

8.4.1   Ecological Health

Based on the three ecological health indicators used by the MBSS, the overall condition of Anne Arundel County streams during the 2000-2004 MBSS was Poor (Figure 8-15). The FIBI results indicate that only 14% of the streams in the county were in Good condition, and 9% rated Good using the BIBI. Using the combined indicator (CBI), 62% of the streams in the county scored as Poor or Very Poor, 6% scored as Good, and 31% scored as Fair.

The few sites with Good IBIs in the county tended to be mostly clustered in the northwestern portion of the county, with a few sites located in the southwestern portion as well. In contrast, Very Poor sites were found throughout the county, including extensive Stream Waders samples in the eastern half of Anne Arundel County. The highest rated stream in Anne Arundel County using the Combined Biotic Index (CBI) was Lyons Creek, while the lowest rated streams included Marley Creek, Cabin Branch, and an unnamed tributary to Smith Creek (Table 8-7). Based on Stream Waders volunteer data, most watersheds in the county had a large number of sites rated as Poor or Very Poor for benthic macroinvertebrates, and sites rated Good were only found in the Middle Patuxent River and Severn River watersheds (Table 8-8).

8.4.2   Physical Habitat

8.4.2.1   Overall Condition

Based on the Physical Habitat Index (PHI), 16% of the streams in Anne Arundel County had Minimally Degraded habitat, 40% had Partially Degraded habitat, and 44% had Degraded or Severely Degraded habitat (Figure 8-16). Most sites rated as having Severely Degraded physical habitat were located in the northern portion of the county near Baltimore, while sites rated as being Minimally Degraded were found in the western portion of the county.

8.4.2.2   Trash

About 29% of the stream miles in Anne Arundel County were rated Optimal for trash and 31% were rated as being
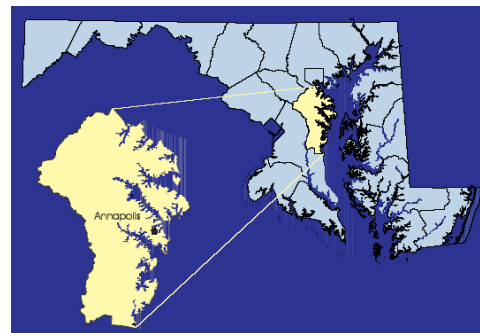
in Marginal or Poor condition (Figure 8-17). All sites with high levels of trash were found in the northern half of the county. In contrast, sites with minimal trash (Optimal) occurred throughout the county but were more common in the western areas.

8.4.2.3   Channelization

Nearly 20% of the stream miles in Anne Arundel County were channelized (Table 8-4). Concrete and dredged channels were the two most common types of channelization, followed by rip-rap and gabions (Figure 8-18). Most channelization in the county was found in the northern portion of the county.

8.4.2.4   Inadequate Riparian Buffer

About 3% of the stream miles in Anne Arundel County during the 2000-2004 MBSS had no riparian buffers. In addition, 12% of stream miles had severe breaks in the riparian buffer zone. There was no geographic trend in the distribution of bufferless sites or sites with buffer breaks (Figure 8-19). Additional information about buffer breaks, analyzed by county, is provided in: 2000-2004 Maryland Biological Stream Survey Volume 10: Riparian Zone Conditions (http:www/dnr/Maryland.gov/streams/pubs/ea05-7_riparian.pdf).

8.4.2.5   Eroded Banks/Bedload Movement

Forty percent of the stream miles in Anne Arundel County were rated as Poor or Marginal for bank erosion (Figure 8-20). In contrast, 31% of streams were rated as having low (Optimal) bank erosion. Streams with minimal bank erosion were clustered in the northern part of the county, while sites with severe bank erosion were widely distributed.

About 50% of the stream miles in Anne Arundel County had minor or no bar formation (Figure 8-20). About 6% of streams in the county were classified as having extensive bar formation. Bar formation was lowest in the northern part of the county.

8.4.3 Key Nutrients

8.4.3.1 Nitrate-Nitrogen

Nearly 72% of the stream miles in Anne Arundel County had nitrate-nitrogen levels less than the 1 mg/l threshold that is the upper bound for streams in mostly forested watersheds (Figure 8-21). No streams had levels above 5 mg/l, the level beyond which biological impacts have been documented. Few sites in the West and South Rivers had elevated nitrate-nitrogen levels, while sites in other watersheds contained a mixture of low and elevated values.

8.4.3.2 Total Phosphorus

An estimated 44% of all stream miles in Anne Arundel County had spring baseflow values of total phosphorus at or below the upper bound of streams in mostly forested (>90%) watersheds (Figure 8-22). Conversely, 28% of streams had levels associated with biological impacts. Most sites with high total phosphorus levels were located in the southern part of the county. The sites with low levels were primarily found in the northern, more developed part of the county.

8.4.4 Stream and River Biodiversity

To provide a means to prioritize stream systems for biodiversity protection and restoration within each county and on a statewide basis, a tiered watershed and stream reach prioritization method was developed. Special emphasis was placed on state-listed stream and riverine species, stronghold watersheds for state-listed stream and riverine species, and stream reaches with one or more state-listed stream fauna. Fauna considered included stream salamanders, freshwater fishes, and freshwater mussels. Rare, pollution-sensitive benthic macroinvertebrates collected during the 1994-2004 MBSS were also used to identify the suite of watersheds necessary to conserve the full array of known stream and river biota in Maryland. A complete description of the biodiversity ranking process is found in: 2000-2004 Maryland Biological Stream Survey Volume 9: Stream and Riverine Biodiversity (http:www/dnr/Maryland.gov/streams/pubs/ea05-6_biodiv.pdf).

Of the eight watersheds found in Anne Arundel County, the highest rated for Stream and River Biodiversity was the Little Patuxent River, a Tier 1 watershed that was a stronghold for one or more state-listed species (Figure 8-23). The only Tier 2 watershed (Stronghold for non-state listed species of Greatest Conservation Need (GCN)) was

Patuxent River Upper. In contrast, the Middle and Lower Patuxent River watersheds were the lowest ranking for stream and river biodiversity in Anne Arundel County, and nearly in the state (78th and 79th of 84). Reaches that had either state-listed species or high intactness values were highlighted to facilitate additional emphasis in planning restoration and protection activities. A complete description of the biodiversity ranking process is found in Volume 9 of this report: 2000-2004 Maryland Biological Stream Survey Volume 9: Stream and River Biodiversity (http:www/dnr/Maryland.gov/streams/pubs/ea05-6_biodiv.pdf).

8.4.5 Stressors

At 90% of stream miles, the most extensive stressor characterized by the MBSS in Anne Arundel County during the 2000-2004 MBSS was non-native terrestrial plants in the riparian zone (Figure 8-5). Other stressors found extensively were: streams with watershed > 5% urban land use (66% of stream miles); non-native aquatic fauna (present in 56% of stream miles); eroded banks (49% of stream miles); and acid deposition (observed in 32% of stream miles). and channelized streams (11% of stream miles). Several other stressors affected 5% or more of the stream miles in the county. These included areas with channelized streams and low dissolved oxygen.

AN IMPORTANT NOTE ON BIODIVERSITY MANAGEMENT

Perhaps the largest ongoing natural resources restoration and protection effort in Maryland is associated with the Chesapeake Bay. In most cases, freshwater biodiversity is not specifically considered during placement and prioritization of Bay restoration and protection projects. In this report, and in the more detailed volume in the series on aquatic biodiversity, a system of biodiversity ranking is presented to provide counties and other stewards with a means to plan appropriate protection and restoration activities in locations where they would most benefit stream and river species. Given the historically low level of funding for biodiversity protection and restoration in Maryland and elsewhere, the potential benefit of incorporating freshwater biodiversity needs into other efforts is quite large.

However, it is important to note that although freshwater taxa are the most imperiled group of organisms in Maryland, other groups and individual species not typically found in freshwater habitats are also at high risk and constitute high priority targets for conservation. In addition, freshwater taxa that prefer habitats such as small wetlands may not be well-characterized by the ranking system employed here. To conserve the full array of Maryland's flora and fauna, it is clearly necessary to use other, landscape-based tools and consider factors such as maintaining or reconnecting terrestrial travel corridors.

Key to MBSS 2000-2004 County Maps

Tier 1: Stronghold watershed (most robust remaining population) for one or more state-listed fish, aquatic herpetofauna, or freshwater mussels.

Tier 2: Stronghold watershed for one or more non-state listed species of greatest conservation need (GCN) fish, aquatic herpetofauna, or freshwater mussels, that also had state-listed fish, aquatic herpetofauna, or freshwater mussels present.

Tier 3: Stronghold watershed for one or more non-state listed GCN fish, aquatic herpetofauna, or freshwater mussels, no state-listed fish, aquatic herpetofauna, or freshwater mussels present.

Tier 4: Non-stronghold watershed with one or more state-listed fish, aquatic herpetofauna, or freshwater mussels present.

Tier 5: Not of the above, but a biodiversity conservation watershed. In other words, part of the network of watersheds that must be conserved to keep all native fishes, aquatic herpetofauna, freshwater mussels, and rare, pollution sensitive benthic macroinvertebrates extant in Maryland.

Tier 6: Not of the above.

Index of Biotic Integrity

Symbol types and data sources

benthos
fish
MBSS

benthos
fish
Sentinel

benthos
fish
Non-random

County
fish
benthos

benthos only

Stream waders

Colors used in symbols

- Very Poor
- Poor
- Fair
- Good
- Not rated

MBSS Round 1 data are shown in muted colors

Channel Condition

Symbol types and data sources

MBSS

Non-random

Bar Formation
- Extensive
- Moderate
- Minimal
- None
- Not rated

Erosion
- Poor
- Marginal
- Suboptimal
- Optimal
- Not rated

Riparian Buffer Condition

Symbol types and data sources

MBSS

Non-random

Buffer break
- Yes
- No

Riparian Width
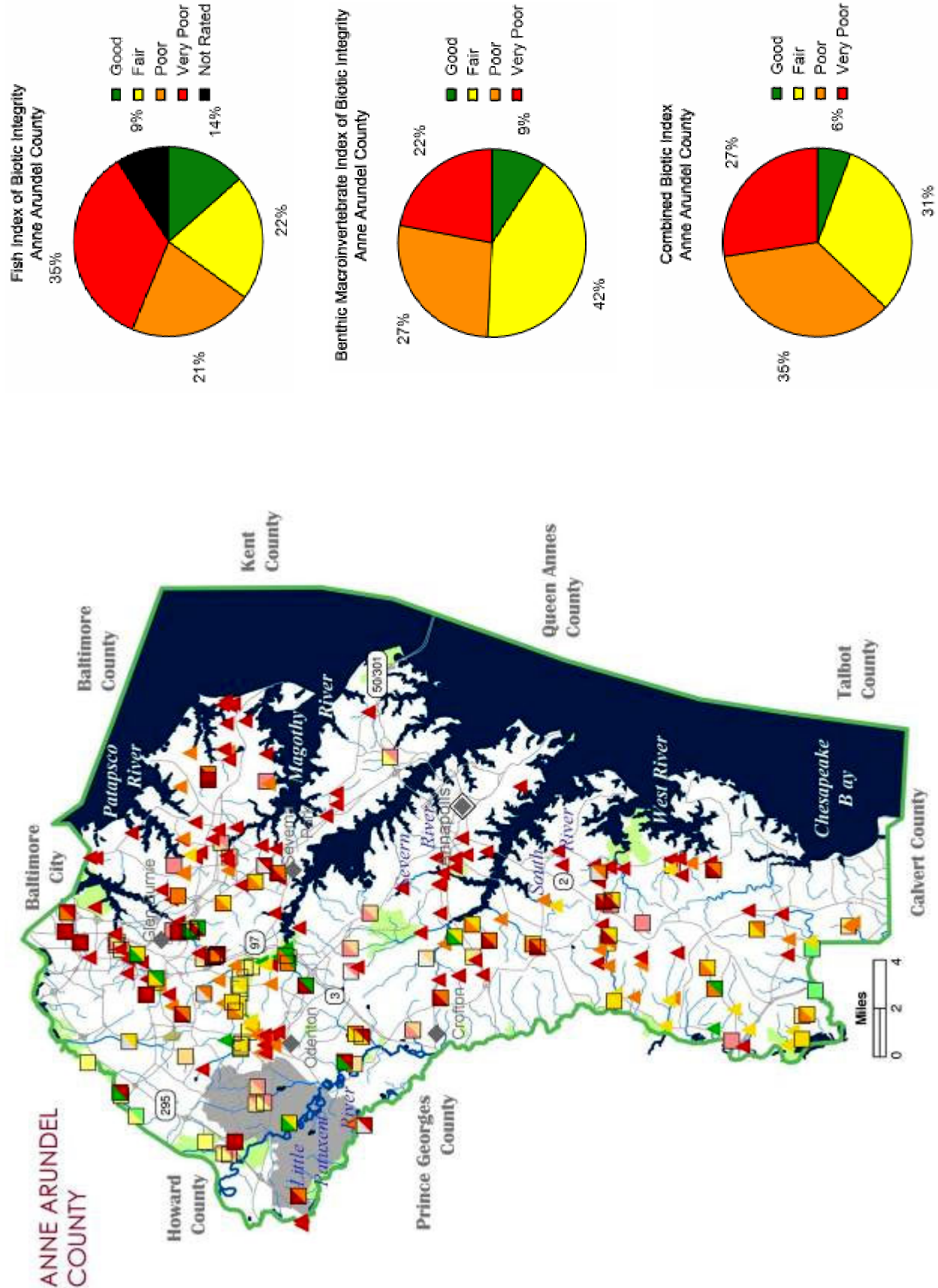- No buffer
- 1 – 5 meters
- Greater than 5 meters

8-29

Figure 8-15. Benthic Index of Biotic Integrity (BIBI) and Fish Index of Biotic Integrity (FIBI) pie charts and map of stream health for Anne Arundel County streams sampled by the MBSS during 1995-97 and 2000-2004 (pie chart represents 2000-2004 data only, Combined Biotic Index pie chart represents mean of FIBI and BIBI).

Table 8-7. MBSS sites sampled in Anne Arundel County during 1994- 2004, ranked by Combined Biotic Index Score (CBI)

Anne Arundel County - MBSS Sites

SITE NUMBER	STREAM NAME	WATERSHED	CBI	SITE NUMBER	STREAM NAME	WATERSHED	CBI
Best (in order of CBI score)				*Worst (most degraded sites first)*			
CA-S-197-302-97	Lyons Creek	Patuxent River Middle	4.83	AA-S-037-214-97	Smith Creek UT	West River	1.00
LPAX-408-R-2000	Little Patuxent River	Little Patuxent River	4.14	BALT-106-R-2001	Marley Creek UT3	Baltimore Harbor	1.00
BALT-214-R-2001	Marley Creek	Baltimore Harbor	4.10	BALT-104-R-2001	Marley Creek	Baltimore Harbor	1.00
BALT-214-R-2004	Sawmill Creek	Baltimore Harbor	4.02	BALT-103-R-2001	Cabin Branch UT1	Baltimore Harbor	1.00
SOUT-108-R-2002	Tarnans Branch	South River	4.00	AA-N-012-110-97	Muddy Creek UT	West River	1.14
AA-N-030-223-95	Deep Run UT	Patapsco River Lower North	3.90	AA-N-190-101-97	Patuxent River UT	Patuxent River Middle	1.17
PAXM-213-R-2001	Cabin Branch	Patuxent River Middle	3.76	LPAX-118-R-2000	Little Patuxent River UT2	Little Patuxent River	1.17
AA-N-091-303-97	Severn Run	Severn River	3.71	AA-N-211-101-97	Mill Swamp Brach UT	West River	1.29
AA-N-281-310-97	Severn Run	Severn River	3.69	AA-N-020-124-96	Sloop Cove UT	Baltimore Harbor	1.29
SEVE-203-R-2003	Jabez Branch	Severn River	3.67	AA-N-262-101-96	Marley Creek	Baltimore Harbor	1.29
BALT-202-R-2001	Sawmill Creek	Baltimore Harbor	3.67	BALT-116-R-2004	Curtis Creek UT	Baltimore Harbor	1.29
BALT-207-R-2001	Marley Creek	Baltimore Harbor	3.64	BALT-108-R-2001	Northwest Harbour UT1	Baltimore Harbor	1.45
AA-N-172-209-95	Sawmill Creek	Baltimore Harbor	3.60	BALT-103-R-2004	Cabin Brach Curtis Creek	Baltimore Harbor	1.48
AA-N-091-305-97	Severn Run	Severn River	3.60	AA-N-075-122-97	Bacon Ridge Brach UT	South River	1.57
AA-N-323-225-96	Sawmill Creek	Baltimore Harbor	3.48	SOUT-103-R-2002	Flat Creek	South River	1.57
AA-N-063-232-97	Dorsey Run	Little Patuxent River	3.48	MAGO-113-R-2003	Cattail Creek (WC) UT1	Magothy River	1.57
PAXU-212-R-2004	Stocketts Run	Patuxent River Upper	3.45	BALT-118-R-2004	Sawmill Creek	Baltimore Harbor	1.57
AA-N-091-314-97	Severn Run	Severn River	3.45	BALT-119-R-2004	Fork Brach	Baltimore Harbor	1.62
AA-N-230-319-97	Severn Run	Severn River	3.45	AA-N-209-104-97	Magothy River UT	Magothy River	1.64
AA-N-281-311-97	Severn Run	Severn River	3.43	BALT-108-R-2004	Cabin Brach Curtis Creek	Baltimore Harbor	1.64
PAXM-101-R-2001	Ferry Branch	Patuxent River Middle	3.38	SOUT-106-R-2002	South River UT1	South River	1.71
SEVE-210-R-2003	Jabez Branch	Severn River	3.36	SOUT-105-R-2002	Bell Branch UT1	South River	1.71
AA-N-135-301-97	Severn Run	Severn River	3.33	AA-N-258-121-97	Deep Ditch Branch UT	Severn River	1.71
AA-N-091-320-97	Severn Run	Severn River	3.31	BODK-127-R-2004	Main Creek UT1	Bodkin Creek	1.71
AA-N-230-302-97	Severn Run	Severn River	3.31	BODK-101-R-2001	Main Creek UT2	Bodkin Creek	1.76

Table 8-8. Stream Waders sites sampled in Anne Arundel County during 2000-2004, ranked by Family-level Benthic Index of Biotic Integrity

Anne Arundel County - Stream Wader Sites				
WATERSHED	# GOOD	# FAIR	# POOR	# VERY POOR
Baltimore Harbor	0	1	8	29
Bodkin Creek	0	0	4	7
Little Patuxent River	0	3	3	11
Magothy River	0	1	3	16
Patapsco River L N Branch	0	0	2	2
Patuxent River Lower	0	0	2	0
Patuxent River Middle	1	8	4	7
Patuxent River Upper	0	1	4	5
Severn River	4	8	10	15
South River	0	1	4	27
West River	0	1	1	10

In 2003, the Anne Arundel County Office of Planning and Zoning decided to include physical, chemical and biological techniques in their stream monitoring program to document and track changes in the condition of their stream resources. In the past, the county used a combination of chemical sampling, stream inspection, stormwater sampling, and a limited amount of biological sampling to assist in environmental decision-making. The County will sample biology and stream habitat at approximately 240 sites over a 5-year period (2005 – 2009), and will integrate biological sampling program results with chemical, hydrologic, physical habitat and land use data to better characterize stream condition.

Sampling sites will be randomly drawn using the National Hydrology Dataset. The number of sites to be sampled will be calculated by performing a statistical power analysis using Coastal Plain data from the MBSS in order to meet Data Quality Objectives.

Data collected will include site latitude and longitude, pH, dissolved oxygen, water temperature and conductivity, benthic macroinvertebrates using MBSS methodologies (Kazyak 2001), and physical habitat assessment using Rapid Bioassessment Protocols (RPBs) (Barbour et al. 1999) for Low Gradient streams and/or other methodologies specified by the County. In addition, stream cross-sectional measurements will be taken along with a Modified Wolman Pebble Count. The MBSS BIBI will be calculated using the Coastal Plain version of the BIBI (Stribling et al. 1998).

Both field sampling and data analysis methods are intended to be directly comparable to DNR's MBSS, and complementary to those currently in place in Prince George's, Montgomery and Howard Counties (Hill and Stribling 2004). The monitoring program will coordinate, to the extent possible, with other ongoing monitoring programs so increased benefits can be derived from data sharing, the use of joint reference sites and reference conditions, the ability to produce ecological assessments that are more regional in scope, and the potential for increased cost- and time-efficiencies. Comparability of methods and results will provide a stronger link to other local, state, and national monitoring efforts.
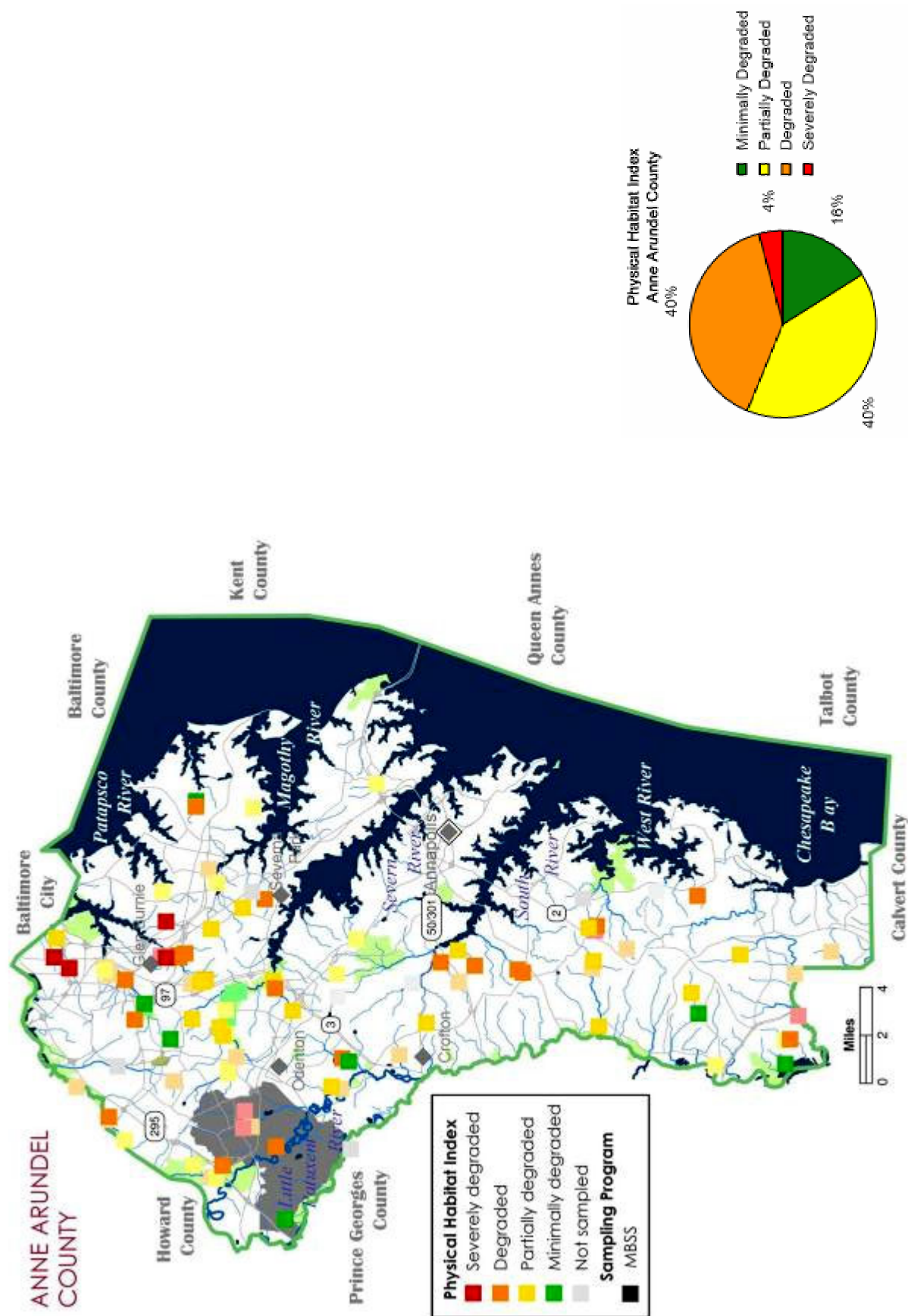
Figure 8-16. Physical Habitat Index (PHI) pie chart and map of stream habitat quality for Anne Arundel County streams sampled by the MBSS during 1995-97 and 2000-2004 (pie chart represents 2000-2004 data only).
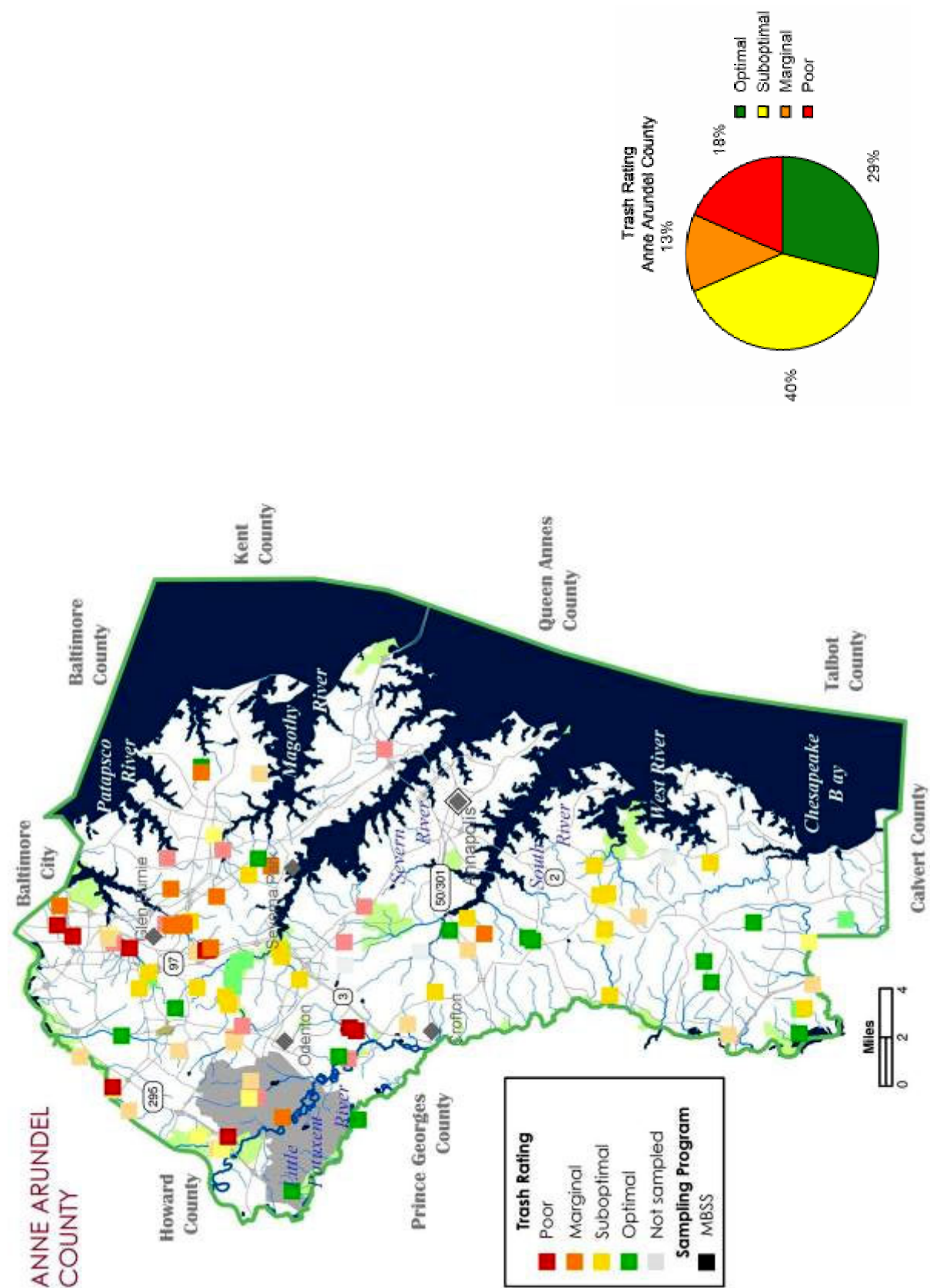
Figure 8-17. Pie chart and map of trash rating (0-20 scale) for Anne Arundel County streams sampled by the MBSS during 1995-97 and 2000-2004 (pie chart represents 2000-2004 data only).
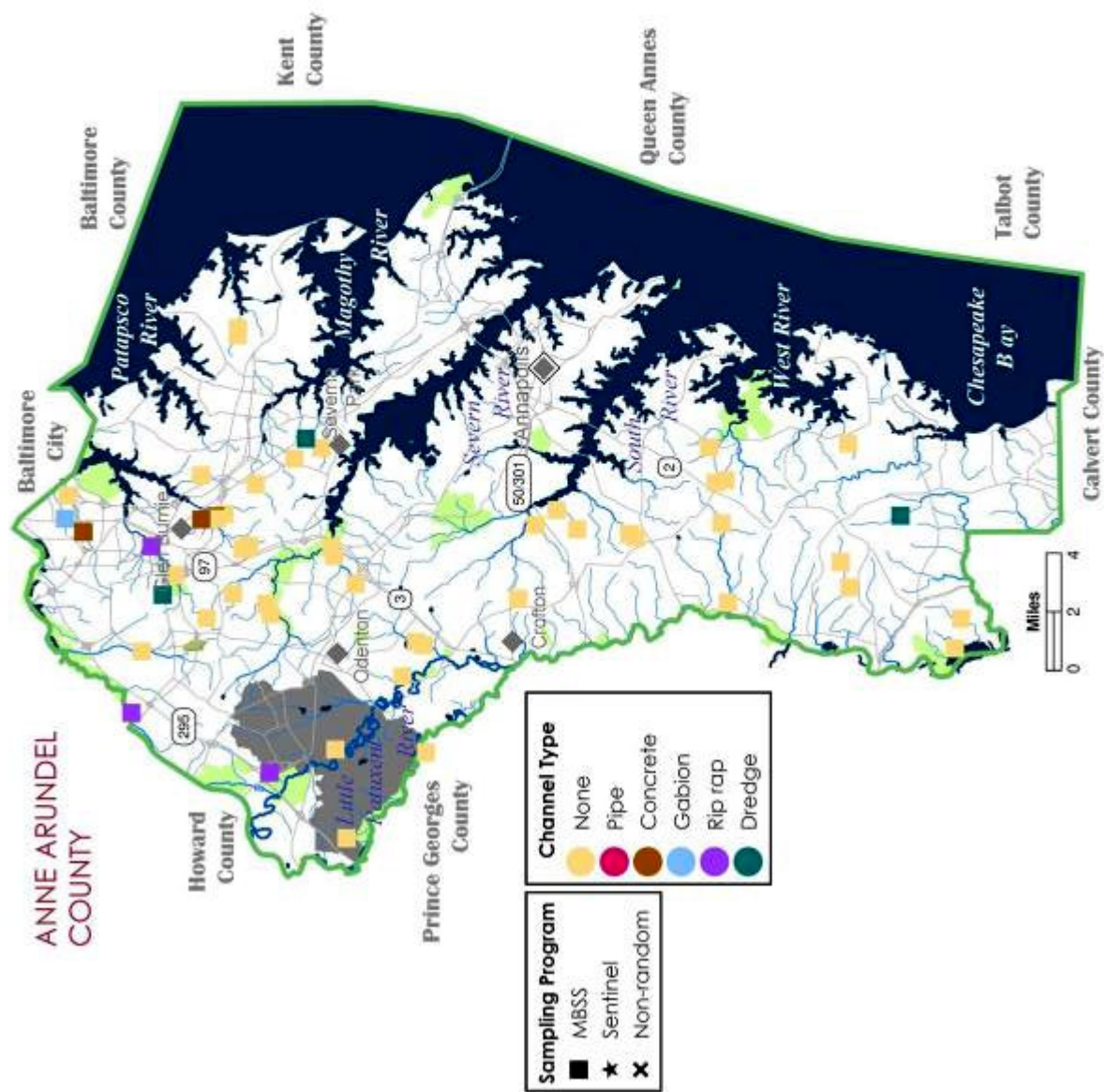
Figure 8-18. Map of channelized sites, by type, for Anne Arundel County streams sampled by the MBSS during 2000-2004. *NOTE: When channelization is indicated, it does not necessarily mean that the entire 75m segment was affected.*
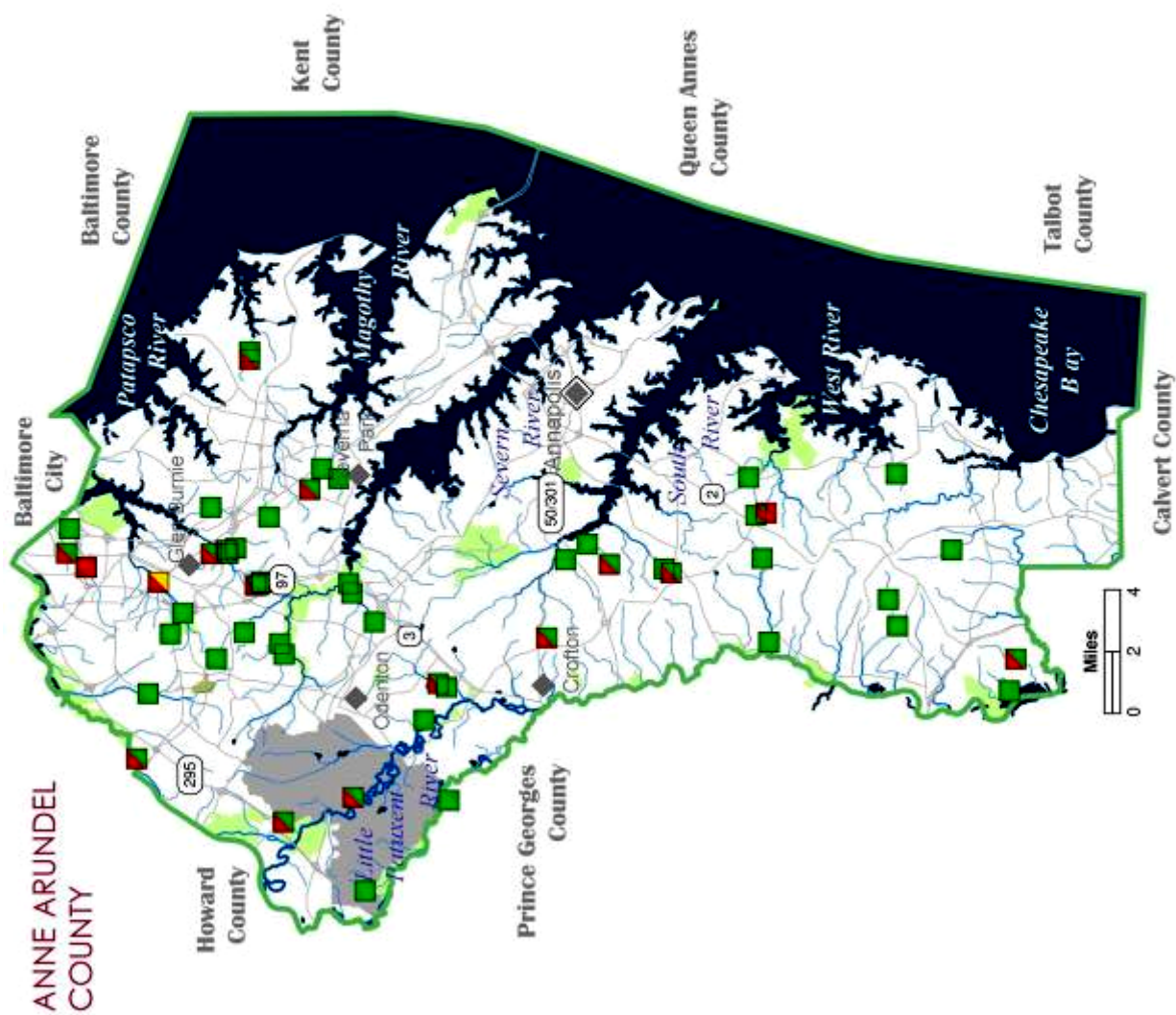
Figure 8-19.　Map of sites with inadequate riparian buffers and buffer breaks for Anne Arundel County streams sampled by the MBSS during 2000-2004. *NOTE: Multiple riparian buffer breaks sometimes occurred at a site; only the most severe was depicted.*
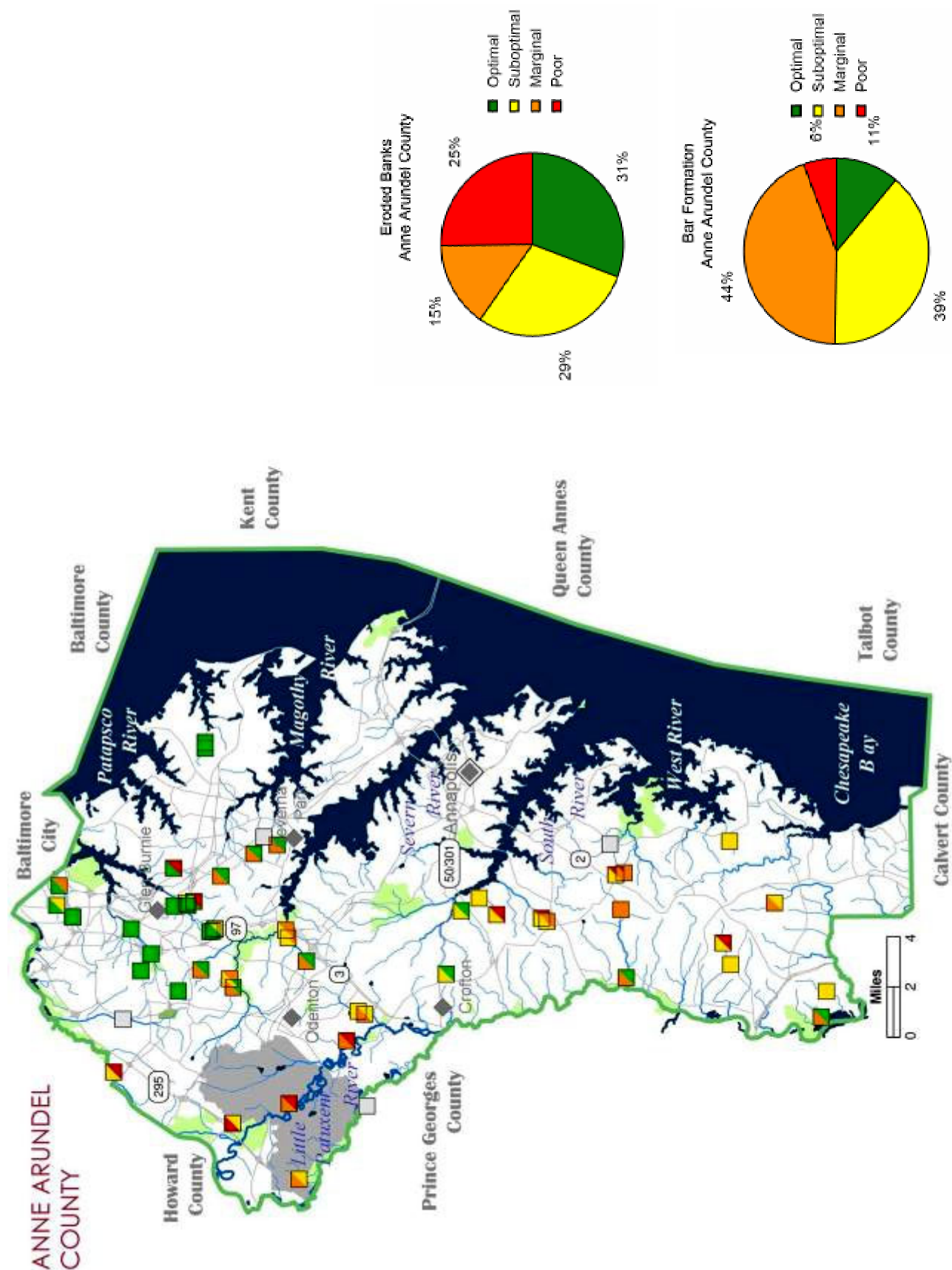
Figure 8-20. Pie charts and map of sites with eroded banks and instream bar formation for Anne Arundel County streams sampled by the MBSS during 2000-2004
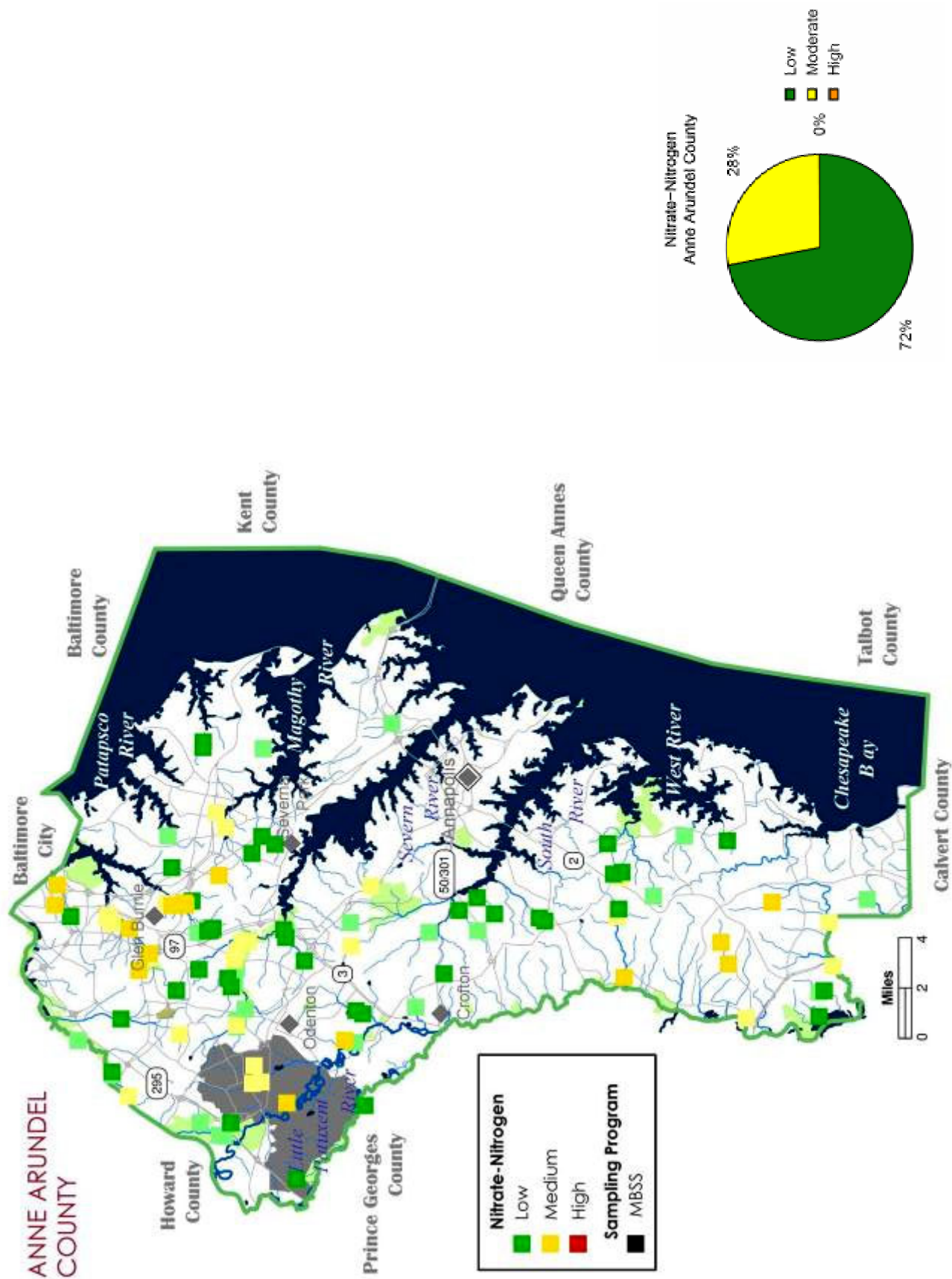
Figure 8-21.   Pie chart and map of nitrate-nitrogen values (mg/l) for Anne Arundel County streams sampled by the MBSS during 1995-97 and 2000-2004 (pie chart represents 2000-2004 data only). (Low = 1.0, Medium = 1.0 – 5.0, High = > 5.
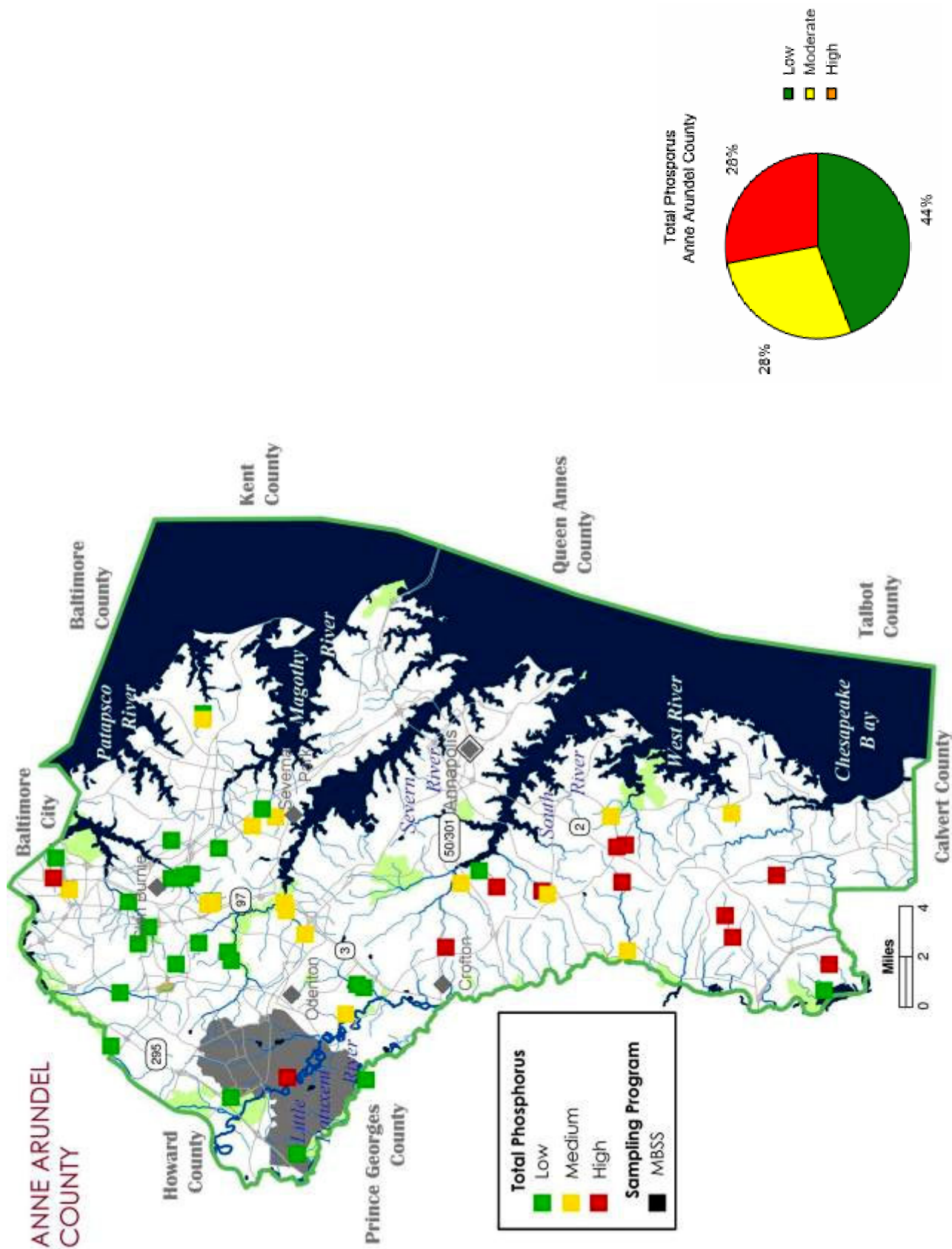
Figure 8-22. Pie chart and map of total phosphorus values (mg/l) for Anne Arundel County streams sampled by the MBSS during 2000-2004. (Low = < 0.025, Medium = 0.025 – 0.07, High = > 0.07)
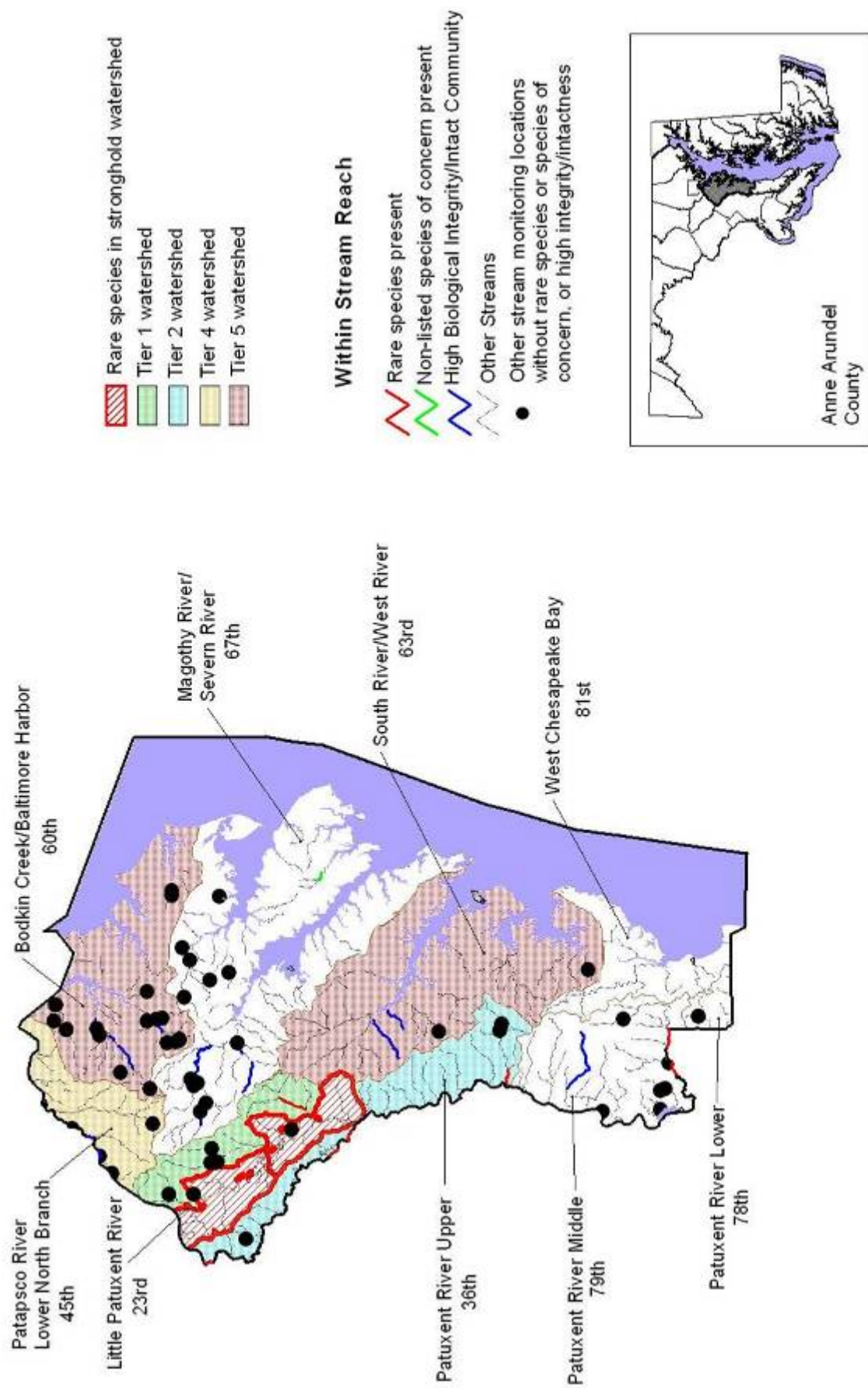
Figure 8-23. Aquatic Heritage Biodiversity Ranking map for Anne Arundel County, by watershed. Data from MBSS 1994-2004, MBSS qualitative data, Raesly, unpub. Data, Harris 1975, Thompson 1984, and DNR Natural Heritage Program database.

Rare species in stronghold watershed

Tier 1 watershed

Tier 2 watershed

Tier 4 watershed

Tier 5 watershed

Within Stream Reach

Rare species present

Non-listed species of concern present

High Biological Integrity/Intact Community

Other Streams

Other stream monitoring locations without rare species or species of concern, or high integrity/intactness

Anne Arundel County

Patapsco River Lower North Branch 45th

Bodkin Creek/Baltimore Harbor 60th

Little Patuxent River 23rd

Magothy River/ Severn River 67th

South River/West River 63rd

West Chesapeake Bay 81st

Patuxent River Upper 36th

Patuxent River Middle 79th

Patuxent River Lower 78th